NEW RIVER BRIDGE
Spanning the New River on State
Route 623, .4 mile southwest of Pembroke
Pembroke vicinity
Giles County
Virginia

HAER No. VA-68

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

HAER
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HISTORIC AMERICAN ENGINEERING RECORD

NEW RIVER BRIDGE HAER NO. VA-68

Location: Spanning the New River on State Route 623, .4 mile southwest of Pembroke, Pembroke vicinity, Giles County, Virginia.

UTM: 17.4129640.531560
QUAD: Pearisburg, Virginia (photo-revised 1985)

Date of Construction: 1915-1916

Engineer: Unknown

Present Owner: Virginia Department of Transportation
1401 East Broad Street
Richmond, Virginia 23219

Present Use: Vehicular bridge

Significance: The New River Bridge at Pembroke is unusual in its combination of various truss types and engineering details, many of which are unique in the area and survive only rarely statewide. Built in 1915-1916 by the Virginia Bridge and Iron Company of Roanoke, Virginia, it combines seven spans, six of which are carried by metal trusses of four different varieties. The bridge demonstrates the persistence of at least three early technological solutions generally abandoned by the turn of the century: nonriveted field construction, the use of all pin connections (on the three main spans), and the incorporation of hand-forged welds and wrought iron for various structural members. Within the state, it contains the greatest number and variety of truss types for a given automotive crossing. Additionally, Virginia's longest Pennsylvania Petit through truss is found here, being the last of three bridges of this type to survive. Two other rare statewide features are metal column piers and a Pratt deck truss, the last of two to survive. The New River Bridge is nestled against Castle Rock, one of the most scenic natural formations in the region. The juxtaposition of technological and natural landmarks makes for a uniquc site.

Project Information: This documentation was undertaken in July and August 1993 in accordance with the Memorandum of Agreement between the Virginia Department of Transportation, Federal Highway Administration, Advisory Council on Historic Preservation, and the Virginia Department of Historic Resources as partial mitigation

of the impact from the proposed replacement of the State Route 623 Bridge, Pembroke. Historical research was conducted by Charles Downing of the William and Mary Center for Archaeological Research (WMCAR). The physical analysis and description were undertaken by Mark R. Wenger and Willie Graham, consultants to the WMCAR.

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From the beginning of the nineteenth century, the busiest New River crossing in western and central Giles County was Snidow's Ferry, which operated very near the modern Route 460 bridge about two miles west of the Route 623 Bridge. Christian Snidow and later his son, Christian L. Snidow, owned a 400-acre farm on the east side of the New River from which they and their descendants operated a ferry (Giles County Records [GCR] Will Book [WB] B:316; Land Books [LB] 1851-1852). Snidow's Ferry provided local access from the north and east to the Giles County seat of Pearisburg as well as serving as the New River crossing along the stagecoach line from Washington, D.C. to Knoxville, Tennessee (Scherkoske et al. 1992:4).

In the early nineteenth century, Christian Snidow also owned land on the northeast side of the New River two miles east of Snidow's Ferry at the present site of the town of Pembroke (GCR WB B:316). Jacob Snidow and Henley Chapman owned land directly across the river on the southwest side (GCR DB N:225). Here the Snidows, and perhaps Chapman, shared in the operation of a less frequented ferry, which crossed the river a few hundred yards upstream from the present site of the Route 623 Bridge. For consistency and clarity, the ferry that preceded the Route 623 Bridge will be referred to as the Pembroke Ferry, although that name did not come into common use until the 1890s. Prior to the 1890s, the Pembroke Ferry was locally known by the surname of whoever happened to be the ferry keeper at the time (GCR Chancery File [CF] #129). The Snidow family historically owned a part or half interest in the Pembroke Ferry. However, the conveyance was called successively by the surnames of their partners, who actually operated the ferry. Presumably this avoided confusion with the more prominent Snidow's Ferry two miles to the west.

According to an early twentieth-century map of Virginia turnpikes, the Pembroke Ferry would have provided a connection between the Pulaski-Giles Turnpike which ran on the southwest side of the New River, and the Centersville and Peters Mountain Turnpike, which ran on the northeast side (Pawlett 1986). However, it appears that the Pembroke Ferry predominantly handled traffic traveling within the immediate area. The Pembroke Ferry was operated for decades under a series of informal agreements and private contracts (GCR Order Book [OB] 14:193).

Much of the information regarding the ferry was located in the court papers of an 1892 chancery suit styled *J. B. Haupt v. W. L. Snidow, et al.* (GCR CF #129). Currently, the Route 623 Bridge spans the New River at an angle roughly southwest to northeast (USGS 1985). In the mid-nineteenth century, the ferry route ran almost due east and west across the river (Gilmer 1864). On the west side of the river, the ferry landing was situated at the base of the eastern face of Castle Rock, an imposing limestone bluff and a prominent local landmark. On the east side of the river, the landing lay about 1,000 feet upriver from the Route 623 Bridge, almost exactly at the southwestern corner of the present corporate limits of Pembroke. From about the middle of the nineteenth century until the construction of the bridge in 1916, the location of the ferry landings was changed at least twice (GCR CF #129).

The west-side landing of the Pembroke Ferry at the base of Castle Rock appears to have been located on the property of Jacob Snidow. In 1852, Snidow died and left his daughter, Rebecca, a 96-acre tract of land. By 1857, Rebecca Snidow had married Adam Norler and the couple sold the 96-acre tract to Jonas Clyburn for $300 (GCR DB K:247). In 1878, Jonas Clyburn sold the property to M. C. Clyburn (GCR DB N:225). Depositions in the 1892 chancery suit make reference to the "old Clyburn ferry" (GCR CF #129).

In 1872, the New River Railroad, Mining and Manufacturing Company held its first meeting at Pearisburg. The company was formed to construct a railroad from New River Depot in Pulaski County upriver to Mercer County, West Virginia and to engage in iron and coal production. The railway line was surveyed in 1875. It followed the west bank of the New River and included the current stretch that passes beneath the Route 623 Bridge. In 1882, as construction of the railway began, the New River Company merged with the Norfolk and Western Railroad (N&W) (Jacobs 1912:147-148).

In July 1882, M. C. Clyburn sold an 80-foot right-of-way through his land to the N&W for "three hundred dollars plus advantages." In addition to the right-of-way, Clyburn granted the N&W "such as is necessary for double track, deep cutting, and embankments" (GCR DB O:137). The construction of the railroad radically changed the appearance of the river bank within the area of the current bridge. A tunnel was cut through Castle Rock. The Pembroke Ferry landing on the west bank and the road to Pearisburg were relocated. As shown on the 1864 Gilmer map, the road to Pearisburg followed the river bank to Big Walker Creek where it joined with the Pulaski-Giles Turnpike (now designated as Routes 745 and 623). The railroad line was built directly on top of the old road. The new "public road" ran adjacent to the N&W line. Curiously, the 1891 USGS quadrangle shows neither the village of Pembroke, the new road along the railroad, nor the Pembroke ferry (USGS 1891). This omission misled one previous researcher who concluded that the 1882 construction of the railroad eliminated both the road and ferry and cut off the southern access to Pembroke until the Route 623 Bridge was built in 1916 (Scherkoske et al. 1992:6, 8). Depositions from the 1892 chancery suit of *Haupt v. Snidow* indicate the contrary—that ferry and road traffic increased significantly after the railroad began operation (GCR CF #129). As land values near Pembroke increased so did the amount of litigation involving local landowners.

John C. Lafon operated the Pembroke Ferry from its original location on the Clyburn property on the east side of Castle Rock. When construction began on the railroad and tunnel, Lafon moved the ferry near the present western terminus of the Route 623 Bridge. The N&W Railroad paid to build a ferry landing at the new site. A grade crossing connected the new public road to Lafon's new landing. Lafon may also have taken on a second job with the N&W. An 1884 deed refers to the project area as "Lafon's Switch on the New River Division of the Norfolk and Western Railroad" (GCR DB P:135). As the deeds to the N&W called for a double track, there may have been a sidetrack used to regulate train traffic through the single-lane Castle Rock tunnel and for loading at the depot. As Lafon already spent long hours at the site

operating the ferry, he would have been a logical candidate to serve as the railroad switchman as well.

In 1885, Lafon lost both his landing and his interest in the ferry franchise. The Giles County Circuit Court handed down several judgments against Augustus A. Chapman, who had owned the riverfront property on which the new landing had been built. The Pembroke property was not the central issue in the suit. Chapman was apparently a real estate speculator of sorts and had become financially overextended. When questioned by the court, Lafon claimed that he had purchased the landing from Chapman. The court found that the ferry landing was liable to a lien on the property and ordered that it be sold at auction. James W. Williams paid $150 for the narrow slip of land, the ferry landing, and half interest in the ferry franchise (GCR CF #213; DB P:461).

The previous year, James W. Williams had paid M. C. Clyburn $314 for a 33-acre tract that surrounded the ferry landing and through which the N&W track ran. The 33-acres encompassed much of the riverfront in the area and were derived from three separate purchases. Clyburn had bought two of the parcels from the commissioners in the suit against Chapman, and the third was part of the old Jacob Snidow land (GCR DB P:135). Unlike his predecessors, Williams was an entrepreneur who established both a retail and a livery business in addition to running the ferry. In 1886, Williams, who already owned the western half of the ferry franchise, obtained a 15-year lease on the east side from the heirs of George L. Snidow. Williams was entitled to all of the profits from the ferry and virtually exclusive use of the two landings on the east side. The Snidows retained the right to use their boats for private transportation. In return, Williams was to allow the Snidows a 25 percent discount on merchandise from a mercantile business that he intended to establish. About 1886, Williams apparently moved the site of the ferry landing a short distance above the landing that the N&W had built for John Lafon. The new landing was thought to be safer. Although the description is somewhat vague, it seems to suggest that the new landing was separated from the railroad track by an embankment and was now out of sight of the trains. One local resident claimed that horses waiting to cross the river at the old Lafon landing were easily frightened by passing trains (GCR CF #129).

The railroad stop at Pembroke Depot was beginning to attract business interests and related land dealings became increasingly complex. In 1887, Williams sold a one-acre tract (roughly 400 by 100 feet), which encompassed both sides of the railroad right-of-way to the N&W. The deed stipulated that the "conveyance of the land to the edge of the river is for the express purpose of giving [the N&W] water privileges for tanks and other railroad purposes." The N&W was enjoined from interfering with the ferry and the right-of-way over the grade crossing that connected the ferry with the county road. Apparently the construction of a bridge at the crossing had already been discussed. Williams reserved "all right on the river front which may accrue by reason of the erection of a bridge across New River at said point, one abutment of which would rest on the land hereby conveyed." Williams also reserved the right to build a walkway from the station house to a "business house to be erected" (GCR DB P:516).

Williams never completed his plans for his riverfront property. Three months after selling the one-acre tract to the N&W, he sold 40 acres including the ferry landing to Anna C. Haupt for $2,500, or almost eight times what he had paid for the property only three years earlier (GCR DB P:551). Anna Haupt was the wife of former Union General and noted railroad and bridge engineer, Herman Haupt. The Haupts, along with the general's brother Lewis, owned the Mountain Lake Hotel located about five miles north of Pembroke. After the Civil War, they, along with the noted Shakespearean actor Edwin Booth, had been part of a group of northern investors that had purchased the Chambers survey, a 108,000-acre tract of land spread over Giles, Craig, Monroe, and Bland counties (GCR DB M:460; Anonymous 1871:n.p.). The Haupts eventually bought out the interests of most of their partners. In addition to operating the hotel, they eventually formed the Mountain Lake Land Company, a real estate concern. Since the completion of the railroad, Pembroke depot was the station stop used by passengers headed for the Mountain Lake Hotel. After disembarking at Pembroke depot, passengers crossed the river by ferry. Once on the east bank of the river, passengers were taken by hack up the Doe Creek Road to the resort (Givens 1966:27). By purchasing the ferry and the area surrounding the depot, the Haupts were seeking both to consolidate and expand their business interests in the region.

In May 1888, Anna and Herman Haupt leased the ferry to their son, Jacob B. Haupt. The following month, Haupt signed an agreement with the Snidows that allowed him the use of the ferry landing on the east side of the river. Haupt granted the Snidows the use of his landing provided they did not interfere with the operation of the ferry. W. L. and A. W. Snidow, then the owners of the east side ferry landing, operated a nearby sawmill and apparently crossed the river frequently (GCR CF #129). Haupt was under the impression, as were his predecessors, that ownership of the west side ferry landing carried with it a one-half interest in the ferry franchise.

A growing enmity between the Snidow brothers and Haupt erupted into a violent dispute over the ferry. The Snidows claimed that Haupt's ferry landing was old and dangerously dilapidated. Hack drivers would frequently ask to borrow the Snidows's boats. They were unwilling to carry passengers across on Haupt's leaky and poorly maintained boats. In addition, the Snidows claimed that Haupt ran the ferry in a careless manner. On occasions the boats were left untended as Haupt apparently sent the ferryman in his employ on frequent errands. Dr. J. A. Brackett, a physician in Pembroke, complained that when he needed to make evening calls on the west side of the river, he was often left waiting for up to an hour "bellowing" for the ferryman. Most ferries in the immediate region operated until nine o'clock in the evening, but were "on call" for emergencies (GCR CF #129).

On July 11, 1890, the Snidows forcibly seized Haupt's boats and began operating the ferry and collecting the tolls themselves. Haupt filed a suit in the Giles County Circuit Court one month later that remained on the docket for over almost two years. Haupt asserted that the Snidows now "ferried persons, wagons, stock, property, and travel across the river generally" and that he had been deprived of his right to the ferry. He asked the court to restrain the

Snidows from crossing the river "except to use skiffs or canoes for their families and tenants." Several local residents gave depositions in the case. Haupt complained that the Snidows were motivated by money. He pointed out that previous to his ownership the ferry had traditionally yielded "little above actual expenses." The establishment of the N&W depot and the improvements he had made to the landing at "great expense and labor" had turned the ferry into a profitable concession (GCR CF #129).

The key consideration in the case was presented by the Snidows in their formal reply to Haupt's complaint. The Snidows pointed out that "Haupt seeks to convey the Idea that a legal ferry exists or has been established across the New River at the point referred in the said bill." The Snidows declared that "no legal ferry was ever established at this point by law." The Snidows petitioned the court to establish a "public ferry" (GCR CF #129). In June 1892, the county court reached a decision. The "Pembroke ferry" was legally established under the joint ownership of Haupt and the Snidows. The court established the rates to be charged and the two parties were equally responsible for the maintenance of the ferry. It cost fifty cents for a "hack or stage" to cross the river. The schedule of rates indicates that much of the traffic was still related to local agriculture. Two and four-horse wagons were charged 40 and 50 cents respectively. Sheep, hogs, and cattle could be carried across at the respective rate of one, two, and five cents per animal (GCR Chancery Order Book 14:193).

In 1891, in the midst of the ferry suit, Lewis and Herman Haupt incorporated their business interests. The ferry on the east side was now technically owned by the Mountain Lake Land Company (GCR DB R:167). A recent history of the Mountain Lake Resort contains two ca. 1895 photographs that show the east bank ferry landing and a boat bearing a hack crossing the river. From the location of Castle Rock in the background, it can be seen that the ferry crossing was situated at or very near the present site of the bridge (Johnson 1987) In 1896, John and Edwin Sweet paid the Mountain Lake Land Company $1,000 for "the Ferry property with interest in the ferry" (GCR DB T:331). The ferry property was ultimately divided between different members of the Sweet family and was sold to Joseph Doran of Philadelphia in 1902 (GCR DB T:40, 452, and W:456).

Soon after, the Haupts also sold the Mountain Lake Hotel. In 1901, the new proprietors of the Mountain Lake Hotel ceased using the Pembroke station and ferry to bring guests to the resort. The railway station at Eggleston Springs was now the connection point for the hotel. The hacks from the hotel were now dispatched by "telephonic connection" to pickup passengers at the station. In what may have been a telling series of remarks, the new owners assured prospective guests that a "competent man will be put in charge at each end" to assist tourists in traveling to and from the hotel. The owners had also purchased new livery and guaranteed that the hack drivers were "sober and polite" (Dunklee and Porterfield 1891:19).

On the east side of the river, the land and the ferry interest remained in the Snidow family. Shares in the ferry concession were granted to various family members and passed on to their heirs. W. L. and A. W. Snidow had granted their unmarried sister, Sallie J. Snidow,

an interest in the ferry. In 1909, she left her one-quarter interest to her nephew, Brackett Snidow (GCR WB 6:451). The land on the east side of the river remained in the Snidow family until well into the twentieth century.

In 1904, Joseph Doran sold 26.42 acres on the west side of the river "together with the ferry landing situated on the east end of the county road at Pembroke . . . and a one-half interest in the ferry franchise at Pembroke" to the Virginia Company for $3,400 (GCR DB X:493). The Virginia Company appears to have been a real estate holding company which has rented out the property for the last ninety years. In 1987, when the Commonwealth of Virginia purchased a two-acre parcel near the southwest side of the bridge, the grantor was the "Virginia Holding Corporation," the current name used by the original firm (GCR DB 207:729).

In the first two decades of the twentieth century, two important developments brought further changes to the New River crossing at Pembroke. On the east bank of the river, the Virginia Railroad was constructed. The Virginia Railroad operated largely as a low-cost coal carrier. In 1912, the Pembroke Limestone Corporation began quarrying operations on the west side of the river (Snidow and McComas 1927:449). Limestone quarrying became an important industry in Giles County.

With the railway lines operating on the opposing banks of the New River, the development of the limestone industry and other commercial interests in Pembroke, and the increasing population in the local area, the construction of a bridge at Pembroke was seriously considered. As shown above in the James Williams deed of 1887, the construction of a bridge at the site had been under consideration for over twenty-five years. In 1910, the Virginia State Assembly had passed legislation that allowed for the construction of two bridges across the New River. In October and November 1915, the Giles County Board of Supervisors selected the site of the bridge and proposed its construction. On March 20, 1916, the Assembly granted Giles County the authority for construction (GCR Board of Supervisors Order Book [BSOB] 3:318, 320; General Assembly 1916:548). The county was required to eliminate the grade crossing of the N&W on the west side of the river, but no funding to accomplish the task was provided. Ultimately, the N&W eliminated the grade crossing. The N&W conducted "all excavating at the south or western side of the river necessary for the location of the bridge and the road approaches thereto . . . including also the slopes in the said Railway Company's cut" (GCR BSOB 3:339). A small span separated from the highway bridge was erected over the railroad crossing (Scherkoske et al. 1992:10).

The bridge was built by the Virginia Bridge and Iron Company of Roanoke. The construction of the bridge suffered a temporary setback as the result of a flood. A concrete pier near the east bank of the river had been put in place, but perhaps not yet secured. The floodwaters pushed the pier over on its side. The downed pier was left on its side and a new one erected in its place. The damaged pier is still visible beneath the vegetation that has grown around it. At the time the Route 623 Bridge was built, the Virginia Bridge and Iron Company was the second largest industrial establishment in the city of Roanoke. The firm was originally

known as the American Bridge Company. In 1895, the company was incorporated as Virginia Bridge and Iron. In addition to its Roanoke operation, the company at one time operated plants in Atlanta and Memphis, specializing in heavy railroad bridges, as well as producing structural steel and railway cars (Jacobs 1912:112).

In 1922, the Virginia Bridge and Iron Company acquired another plant at Birmingham, Alabama. In 1936, the Tennessee Coal, Iron, and Railroad Company purchased the firm and it was renamed the Virginia Bridge Company. A few months later, it became a subsidiary of United States Steel (Moore 1939:6-7; Works Progress Administration 1942:204). Subsequently, the operation was moved from Roanoke to Pittsburgh. United States Steel sold the division and it operates today as an independent firm known as the American Bridge Company of Pittsburgh. A spokesman from the current American Bridge Company stated that no records dating from the period of construction of the Route 623 Bridge were extant (American Bridge Company 1993, personal communication).

Of the many plats referred to in the Giles County deeds relating to the project area, only a single one is still extant (or was ever actually recorded). In 1926, W. L. Kinzie surveyed the Snidow property on the east side of the river and on the south side of the bridge (GCR DB 48:92). The plat shows the Virginia Railway right-of-way on the east bank of the river along with the subdivisions of the Snidow's property. At the time the plat was drawn, Henley Snidow still owned the land on the north side of the bridge and the highway (GCR DB 54:383, 414, and 86:228). The plat shows the road leading to the N&W depot. This road is now privately owned and closed to traffic.

Previously undocumented, the crossing at Pembroke is a single-mode, steel-truss bridge that carries State Route 623 across the New River on seven spans totaling 792 feet. Six of these are metal trusses, representing four different truss types. Rising on a 2-percent gradient, it stands 35 feet above the water at the east bank and 45 feet at the west bank. Built in 1915-1916 by the Virginia Bridge and Iron Company of Roanoke, Virginia, it was constructed using several technological solutions generally abandoned by the turn of the century: nonriveted field construction, the use of all pin connections (on the three main spans), and the incorporation of hand-forged welds and wrought iron for various structural members. The New River bridge offers a striking example of transitional bridge construction technology, then, illustrating the change from wrought iron to rolled steel, from riveted connections to bolted assembly, and from determinate pinned joints to indeterminate rigid joints (Deibler 1975:I-IX). Furthermore, the variety of truss configurations used here aptly illustrates the parameters set forth by engineers J. A. Waddell, Milo Ketchum, and J. B. Johnson, for matching different truss types to particular situations (Ketchum 1909; Waddell 1921; Johnson et al. 1910). The New River was once crisscrossed by numerous early twentieth-century truss bridges, five having been built in Giles County alone. The Pembroke structure is the last remaining in this county and is reflective of the pattern found along the river's length.

General Remarks

The deck system consists of paired channels below each edge of the roadway with six 52-foot I-section stringers arrayed between. All of these members are borne on 7 x 15 inch floor beams suspended from the trusses on 17-foot 4-inch centers. Only Span 7, simply supported from below, departs from this module. The bridge carries a 15-foot roadway of asphalt on 3 x 10 inch wood decking. This decking is bolted to metal clips that clasp the flanges of the stringers. All but one span is made entirely of rolled sections. Various members are marked with manufacturers' names, including "Pencoyd," "Lackawana," and "Carnegie."

Span 1

This span is a Pratt full-slope pony truss 52 feet in length, with rigid connections. Crossed diagonals, riveted together at their intersection, brace the 17-foot 4-inch central panel. At the panel points, extensions riveted onto the transverse floor beams carry diagonal struts to provide lateral bracing for the trusses. The east end of the span bears on a concrete abutment, the west end on composite steel columns, seated on pyramidal concrete piers. Composite members were made up in the shop with riveted connections and assembled in the field with rigid bolted connections.

The 12 x 6 inch upper chords and inclined end posts are made up of paired 6 x 3-1/2 inch angles connected by lacing on the top face. The intermediate posts are composed of paired, 2 x 2 inch angles riveted to a plate to form a 4-1/2 x 2-3/4 inch channel section. The diagonals and bottom chords are light tensile members, composed of paired 2-1/2 x 2-1/2 inch angles connected at intervals by small riveted plates. The 8 x 9 inch columns that carry the west end of the span are made of paired channels with lacing on both side faces.

Span 2

This is identical to Span 1, the only difference being the supports. The east end of the span shares the columnar supports described above. The west end bears on a high concrete pier composed of paired, telescoping columns connected by solid webbing, the whole standing on a rectilinear base. The upper end is capped with a thick pad on which the trusses bear.

Span 3

This is a seven-panel camelback though truss, 156 feet in length and 24 feet 6 inches high at the center panel. The top chord of this pin-connected truss is a rigid member, sloping upward from each end up to a horizontal run over the central panel. Vertical and diagonal members are suspended from pins in the rigid top chord. An inclined end post meets each chord in a true pin connection. Single diagonals for the end panels run in the tension direction only. All other panels have paired diagonals in the tension position and a single diagonal running in the opposite direction. At each end of the bridge, two diagonal struts brace a single portal strut at its

midpoint. Secondary struts brace the diagonals at their midpoints. At the panel points, lateral struts tie the intermediate posts together and are braced by short diagonal struts. Composite members were fabricated in the shop with riveted connections and assembled in the field with bolts. Bolted to the northwest end post is a cast iron plague reading, "BUILT BY/VIRGINIA BRIDGE/& IRON CO/ROANOKE VA/1916."

The 12 x 8 inch top chord and inclined end posts are made up of paired channels riveted to plates on the upper and lower sides. The hip verticals are 1 x 1 inch wrought iron eye bars with forge-welded loops. The intermediate posts are 8 x 5 inch composite members-paired channels connected by lacing on the front and rear faces. In the end panels, paired diagonals—rolled 2-1/2 x 5/8 inch eye bars with die-forged loops—run in the tension direction only. In all other panels, the diagonals are 1 x 1 inch wrought eye bars with forge-welded loops. In the central panel, all four diagonals are equipped with turnbuckles on threaded rods forge-welded to the square bars. The bottom ehord consists of paired 2-1/2 x 5/8 inch rolled eye bars having die-forged loops. Back-to-back angles comprise the portal and sway struts, while back-to-back angles riveted to a flat plate make up the T-section lateral struts. Bolsters for the 3-inch diameter pins are riveted to the floor beams. At the pins, intersecting members are secured with large hexagonal nuts. Repairs are evident in the replacement of some diagonals with 1-inch rolled steel bars in the compression position.

The east end of Span 3 shares a support with Span 2, already described. The west end bears on a similar concrete pier composed of paired, telescoping columns joined by continuous webbing.

Span 4

This is a pin-connected, five-panel, modified Pennsylvania Petit through truss, 208 feet long and 28 feet high at its center point. This and Span 5 are two of the five remaining Pennsylvania Petit trusses surviving statewide on a total of three bridges. At 208 feet, they are also the longest of their kind, since demolition of the Eggleston bridge, and are the only surviving examples of this type in the Salem construction district. At the center of each panel, a composite vertical member breaks the span of the diagonal tension members and transfers the load of the roadway to the top chord, maintaining the 17-foot 4-inch module of the deck system. In the central panel, the diagonals run in both directions. At each end of the truss, a pair of diagonal struts meet at the center of a single portal strut. Secondary struts brace these diagonals at their midpoints. Lateral struts tie the top chords together at panel and intermediate points. Sway struts tie verticals together only at the panel divisions. All major joints are pinned connections and every member is made of rolled steel. Composite members were fabricated in the shop with riveted connections, and assembled in the field with bolts.

The 9 x 14 inch top chord is a rigid composite member, hinged only at the inclined end posts. Both are made of paired 9 x 2-1/2 inch channels, connected by a plate on the upper face and lacing on the underside. At the panel points, 9 x 7 inch intermediate posts consist of paired

spans of 21 feet 4 inches each. A steel floor beam carried on two composite columns makes up each of the intermediate support assemblies. The east end this segment shares a support with Span 6, already described. The west end bears on a concrete abutment.

Design

Efficiency of the crossing became a paramount decision in bridge design. The most significant judgment to be made included the style of the span (i.e., deck or through), the type of truss, and the design of the substructure. These variables could be adjusted and fine-tuned to produce the most economical solution for a given circumstance (Johnson 1910:1-11). The Pembroke bridge incorporates four different truss types, exhibiting a variety of structural characteristics. At 208 feet, the two Pennsylvania Petit trusses (Spans 4 & 5) are the longest of their type in Virginia. Likewise, the 156-foot camelback truss (Span 3) is one of the longest of its kind in the state. The pinned connections of these three spans are directly related to their extraordinary length. For all trusses exceeding 150 feet—those for which analysis of stresses was particularly critical—bridge engineer Milo Ketcham recommended pinned connections, since these produced a structurally determinate design. It was also important to minimize dead loads for these longer spans, hence the use of light bars for the tensile members. The use of rolled eye bars with hydraulically forged and punched eyes in the Pennsylvania-Petit trusses, versus wrought and forge-welded eye bars in the camelback design, reflects the greater stresses anticipated for the longer spans.

For the shorter approach spans (1 and 2), Pratt pony trusses were favored as the most economical solution. Since determinate design was less critical here, riveted connections could be used to provide added lateral stability. In any event, over-design could compensate for indeterminate design without significantly increasing dead loads. Nonetheless, the tensile elements remain extremely light, being small composite members made up of standard rolled sections.

The rare use of a Pratt deck truss (Span 6) at the west end of the bridge was predicated on the need to stabilize the tall vertical supports, where the steel beam approach span changed the direction of travel and thus introduced significant lateral forces. To achieve this, the bearing points of the deck truss were actually embedded in the concrete piers.

SOURCES OF INFORMATION

During the course of the research, no photographs of the construction nor of the early period of the operation of the bridge were located. The Virginia State Library and Archives, the Virginia Historical Society, and the Norfolk and Western Photograph Collection at Virginia Tech were searched. Similarly, only a single plat depicting the bridge was found in the Giles County records. No plats depicting the property on either side of the river prior to the construction of the bridge were found. A ca. 1856-57 sketch of the project area drawn by Pennsylvania-German folk artist Lewis Miller shows Bullard Rock (Castle Rock) and is on file at the Virginia Historical Society (Rachal 1952:22). Many of the deeds make specific references to lot numbers from plats that were never recorded. A thorough search of related deed records, plat books, and chancery records, along with inquiries made to the court clerk failed to locate any of the pre-1930 plats. For example, a 1902 plat to which direct reference is made in a deed would have been particularly useful. This plat depicted a one- and one-half-mile stretch of the west bank of the river from Castle Rock downriver and around "the horseshoe" past the creek now designated on the current USGS quadrangle as "Stone Quarry Branch" (USGS 1985). This document apparently depicted the ferry landing, the Norfolk and Western Railway's "Pembroke, Virginia station" and perhaps other significant features on the west side of the river (Giles County Records [GCR] Deed Book [DB] W:456).

BIBLIOGRAPHY

Anonymous. 1871. *Description of 10,000 Acres of Land in Giles, Monroe, and Bland Counties.* Pamphlet on file, Virginia State Library and Archives, Richmond.

American Bridge Company. 1993. Personal communication.

Deibler, Dan Grove, and Paula A. C. Spero. 1975-1982. *Metal Truss Bridges in Virginia: 1865-1932.* Vols. 1-9. Charlottesville: Virginia Highway & Transportation Research Council.

Dunklee and Porterfield. 1891. *Mountain Lake and Eggleston Springs, Giles County, Virginia, Season of 1891.* Pamphlet on file, Virginia Historical Society.

—. 1901. *Mountain Lake and Eggleston Springs, Giles County, Virginia, Season of 1901.* Pamphlet on file, Virginia Historical Society.

General Assembly of the State of Virginia. 1916. *Acts and Joint Resolutions of the General Assembly of the State of Virginia.* Richmond: Superintendent of Public Printing.

Gilmer, J. F. 1864. Map of Craig, Giles, Montgomery, and Pulaski Counties. Part 1 of 2. Richmond: Virginia Historical Society.

Giles County Records. n.d. Deed Books, Chancery Files, Land Tax Books, Will Books, and Order Books On file, Office of the Clerk of the Circuit Court, Pearisburg, Virginia.

Givens, Lula P. 1966. Mountain Lake. *Journal of the Roanoke Historical Society* 3(1):27-35.

Jacobs, E. B. 1912. *History of Roanoke City and History of the Norfolk & Western Railway Company*. Roanoke, Virginia: Stone Publishing.

Johnson, J. B. et al. 1910. *The Theory and Practice of Modern Framed Structures.* 9th ed. New York: John Wiley and Sons.

Johnson, Patricia Givens. 1987. *Mountain Lake Resort, Book 1: 1751-1907.* Christiansburg, Virginia: Walpa Publications.

Ketchum, Milo S. 1909. *The Design of Highway Bridges and the Calculation of Stresses in Bridge Trusses*, New York: Engineering News Publishing Co.

Moore, Alice Constance. 1939. *The Story of Roanoke.* Roanoke, Virginia: American Guide Series of the Work Project Administration.

Pawlett, Nathaniel Mason. 1986. Map of Virginia Showing Turnpikes drawn and compiled by S. E. Tompkins. Rev. ed. of 1928 original. In *A Brief History of the Roads of Virginia.* Charlottesville: Virginia Highway Transportation and Research Council.

Rachal, William M. E. A Trip to the Salt Pond: The Rewards of a Vacation Ride from Christiansburg to Mountain Lake in 1853, Portrayed in Sketches by Lewis Miller. *Virginia Cavalcade* II(2):22-27.

Scherkoske, Deborah, et al. 1992. *Phase II Historical and Architectural Investigation Bridge 6018, Route 623 over Norfolk & Western Railroad Tracks, Giles County, Virginia.* Richmond, Virginia: The Cultural Resource Group, Louis Berger & Associates and P. A. C. Spero and Company.

Snidow, F. A., and F. W. McComas, Jr. 1927. *An Economic and Social Survey of Giles County*. Charlottesville: University of Virginia Record Extension.

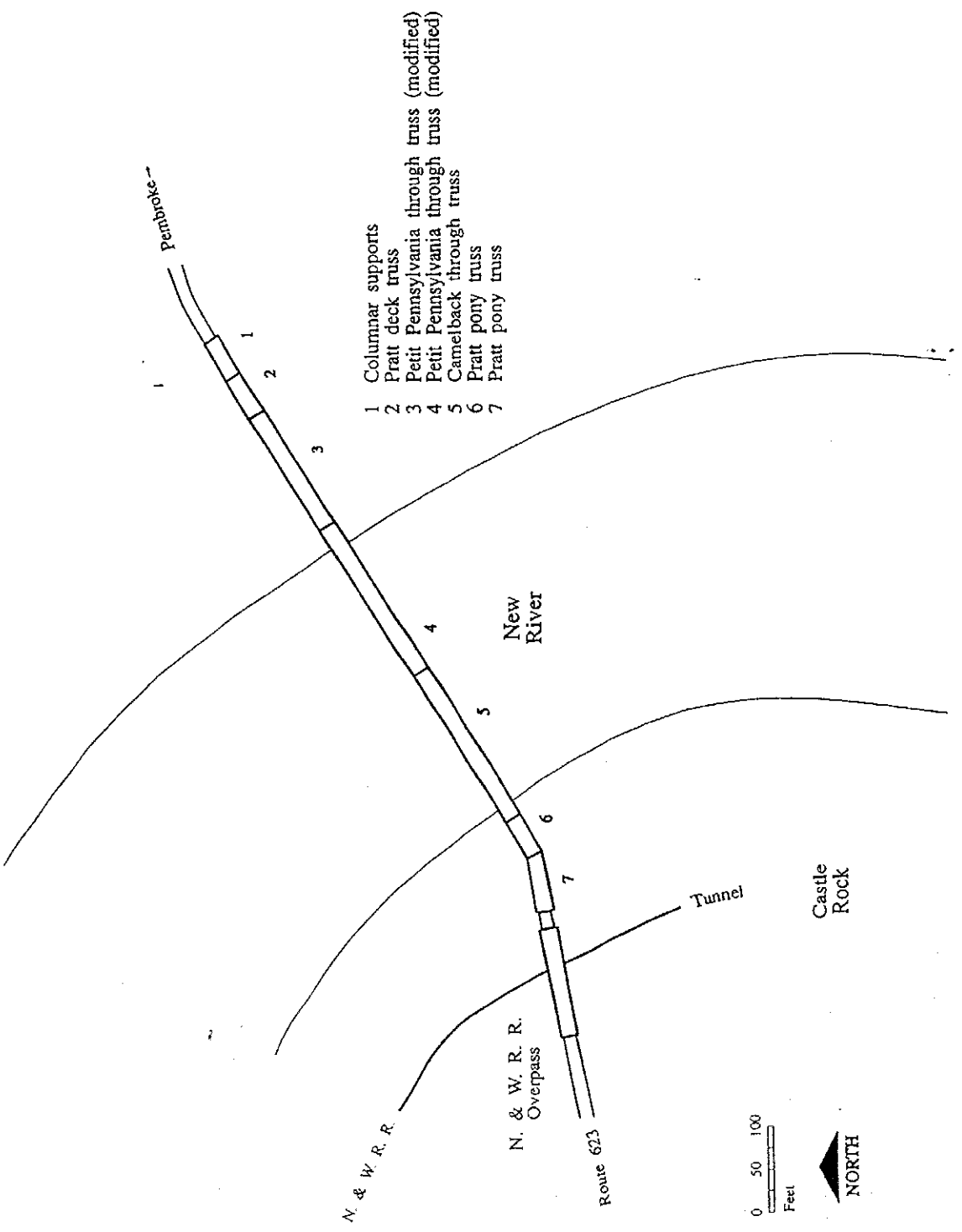
U.S. Geological Survey. 1891. Dublin, VA-WVA quadrangle. 15-minute series. Washington, D.C.: U.S. Geological Survey.

—. 1985. Pearisburg, VA quadrangle, 7.5-minute series. Reston, Virginia: U.S. Geological Survey.

Waddell, J. A. 1921. *Economics of Bridgework: A Sequel to Bridge Engineering*. New York: John Wiley and Sons.

Work Progress Administration. 1942. *Roanoke: Story of County and City*. Roanoke, Virginia: Stone Printing and Manufacturing Company.

Site Plan


1 Columnar supports
2 Pratt deck truss
3 Petit Pennsylvania through truss (modified)
4 Petit Pennsylvania through truss (modified)
5 Camelback through truss
6 Pratt pony truss
7 Pratt pony truss
Pembroke
New River
Tunnel
Castle Rock
N. & W. R. R. Overpass
N. & W. R. R.
Route 623
0 50 100
Feet
NORTH